

Supplementary Material: Fabrication method and performance of light-responsive hydrogel micro valve in the microfluidics chip

Experimental Materials

N-isopropyl acrylamide (NIPAM, Macklin, purity $\geq 98\%$); N,N'-Methylenebisacrylamide (BIS, Macklin, purity $\geq 98\%$); ammonium persulphate (APS, Macklin, purity $\geq 98\%$); 20nm Fe₃O₄ powder (I811859, Macklin, USA); Laponite-RD (Lap-RD, RockWood,GER); N,N,N',N'-Tetramethylethylenediamine (TEMED, Macklin, purity $\geq 99\%$); silicone fluid (Dow Corning, PMX-200, 350cs).

Preparation of light-responsive hydrogel microspheres

As shown in **Supporting Figure 1**, the light-responsive hydrogel microspheres produced could be controlled by adjusting the size of the A and B injection ports and the outlet flow rate of the T-shaped flow channel. The relationship between the particle size of the prepared light-responsive hydrogel microspheres and the preparation parameters (T-shaped flow channel exit flow rate and flow channel structure parameters) was shown in **Supporting Table 1**. The pre-gel solution (A liquid) passed through A injection port is configured according to Table 1. The pre-gel solution was divided into two types with the same solute composition, including 3.6g N-isopropylacrylamide (NIPAM, Macklin, purity $\geq 98\%$), 5.8ml volume fraction of 1% w/v N,N'-methylenebisacrylamide (BIS, Macklin, purity $\geq 98\%$), 3.2ml of ammonium persulphate (APS, Macklin, purity $\geq 98\%$) and volume fraction of 1% w/v, 0.4g of 20 nmFe₃O₄ powder (I811859, Macklin, USA). Two models were named in accordance with different solvents. The solvent of N01 was deionized water without Lap-RD, and the solvent of N02 was an aqueous solution containing 2%wt of Laponite-RD (Lap-RD, RockWood,GER). N,N,N',N'-Tetramethylethylenediamine (TEMED, Macklin, purity $\geq 99\%$) was mixed with silicone fluid (Dow Corning, PMX-200, 350cs) in a volume ratio of 1:10. The mixture was called B liquid, which passed through the B injection ports. As shown in **Supporting Figure 2**, light-responsive hydrogel microspheres with different particle sizes were prepared by a T-shaped flow channel.

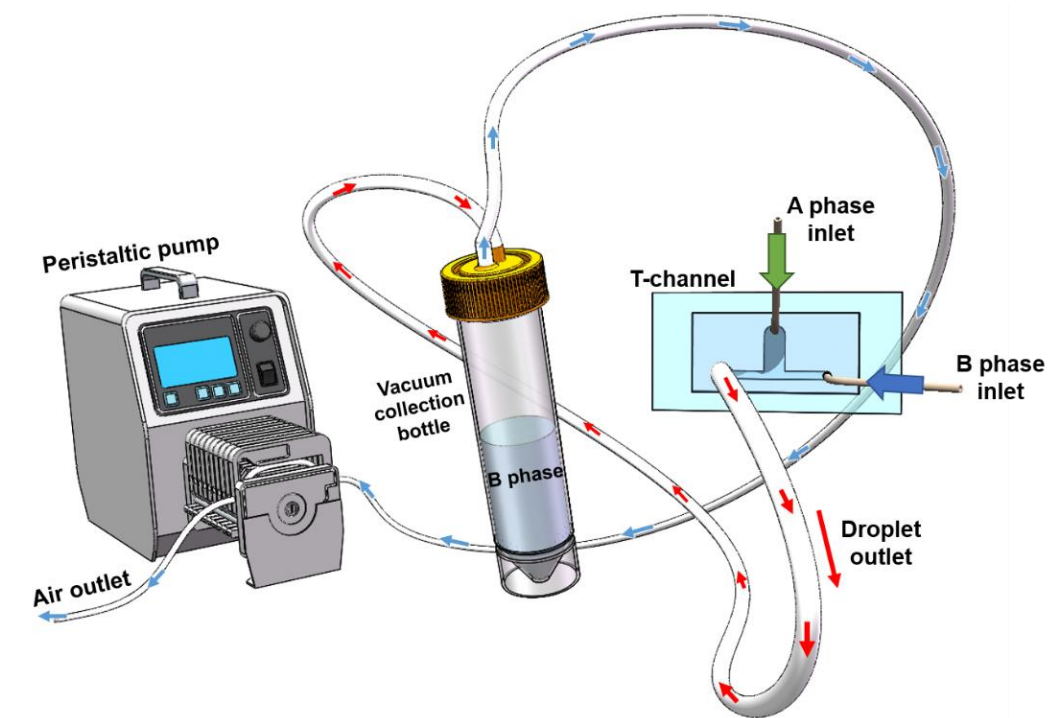


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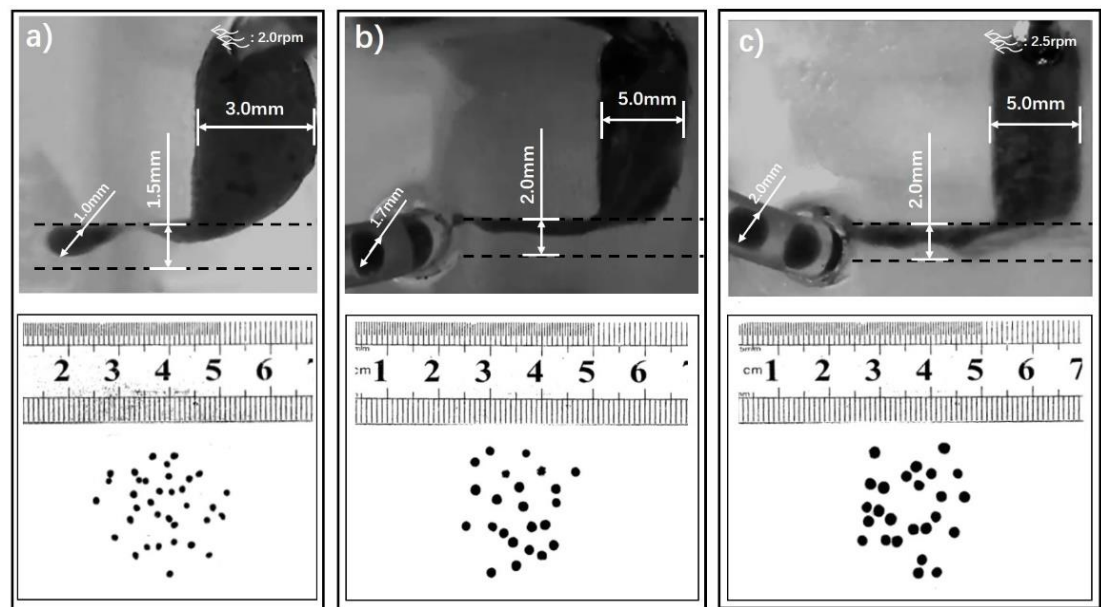
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Supporting Figures:



Supplementary Figure 1. Schematic diagram of droplet generation by T-shaped flow channel.



Supplementary Figure 2. Photo of spherical hydrogel microvalve prepared by T-shaped flow channel. a) 1.0mm light-responsive hydrogel microvalve. b) 1.7mm light-responsive hydrogel microvalve. c) 2.0mm light-responsive hydrogel microvalve.

41 **Supporting Table 1. Process parameters for producing droplets.**

Particle size(mm)	Groove depth of T-shaped flow channel (mm)	B liquid flow channel width (mm)	A liquid flow channel width (mm)	Outlet peristaltic pump speed (RPM)
1.0	1.0	1.5	3.0	2.0
1.7	1.0	2.0	5.0	1.5
2.0	1.0	2.0	5.0	2.5

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